**KEY PAPERS:**

1. **Dymond et al. (2002)** – *Phenological Differences in Tasseled Cap Indices Improve Deciduous Forest Classification* – DOI: [10.1016/S0034-4257(01)00324-8](https://doi.org/10.1016/S0034-4257(01)00324-8)  
   *Summary:* Showed that using multi-date “phenological” indices (e.g. Tasseled Cap greenness/wetness) improved discrimination of forest types. A simple spectral classification misidentified recent clear-cuts as *aspen/mixed deciduous* forest, whereas including seasonal data correctly labeled those areas as shrub/clearing[[1]](https://www.researchgate.net/figure/A-comparison-of-raw-spectral-and-cBGW-classification-of-10-year-old-harvested-stands_fig9_222397391#:~:text=,). This highlights that post-harvest conifer stands with herbaceous regrowth can be confused with deciduous forest in single-date imagery.
2. **Schroeder et al. (2011)** – *Mapping Wildfire and Clearcut Disturbances in Boreal Forests with Landsat Time Series* – DOI: [10.1016/j.rse.2011.02.013](https://doi.org/10.1016/j.rse.2011.02.013)  
   *Summary:* Found that burned and clear-cut areas exhibit similar spectral recovery trajectories (initial loss of canopy, then rapid green-up from grasses/shrubs). NDVI alone could not distinguish disturbance type because both showed a sharp rebound in green vegetation[[2]](https://www.fs.usda.gov/rm/pubs_other/rmrs_2011_schroeder_t001.pdf#:~:text=test%20also%20showed%20that%20fire,economic%20policy%20to%20harvesting%20rates). The study underscores that early post-disturbance vegetation (often deciduous shrubs and herbs) can mimic the spectral/phenological signal of deciduous forests, leading to classification confusion.

**MECHANISM:** After a disturbance (logging, fire, windthrow) in a conifer stand, the evergreen canopy is removed and **fast-growing grasses, herbs, and deciduous shrubs quickly colonize the site**. These pioneer plants produce a strong summer greening signal (high NDVI and reflectance in the near-infrared) that drops off in winter – a phenology very similar to true broadleaf deciduous forests. In contrast, an intact conifer forest has a more muted seasonal signal (retaining some greenness year-round). **Thus, satellite classifiers relying on spectral signatures or NDVI seasonality may interpret the lush summer regrowth in a clear-cut as “deciduous” vegetation**. Additionally, broadleaf shrubs and young deciduous trees often dominate early succession on conifer sites, further causing the spectral profile (e.g. high NIR reflectance, low winter canopy cover) to resemble a deciduous forest[[3]](https://www.mdpi.com/2072-4292/14/23/6003#:~:text=Overall%2C%20seven%20sample%20points%20were,and%20urban%20and%20construction%20land)[[1]](https://www.researchgate.net/figure/A-comparison-of-raw-spectral-and-cBGW-classification-of-10-year-old-harvested-stands_fig9_222397391#:~:text=,). This well-known spectral confusion means that a recently disturbed conifer stand can appear “deciduous-like” in imagery even though it is a transient condition.

**MITIGATION STRATEGIES:**  
- **Mask or flag recent disturbances:** Many studies recommend using ancillary disturbance data or time-series analysis to identify pixels that were recently logged or burned. These areas can be **excluded or marked as a separate “disturbed” class** rather than misclassified as stable forest[[1]](https://www.researchgate.net/figure/A-comparison-of-raw-spectral-and-cBGW-classification-of-10-year-old-harvested-stands_fig9_222397391#:~:text=,). For example, one can apply a forest loss mask (e.g. from annual change maps) to filter out areas <5–10 years since disturbance before labeling forest type.  
- **Use multi-year compositing or phenology:** Instead of a single-date image, combining **leaf-on and leaf-off imagery or multi-year time series** helps distinguish true deciduous forests from ephemeral regrowth. A classifier that incorporates phenological indices (e.g. difference between summer and winter imagery) will detect that a *persistent* deciduous forest shows this pattern every year, whereas a recovering clear-cut’s signal may be more irregular. Dymond et al. (2002) demonstrated that including seasonal Tasseled Cap indices reduced confusion between harvest-regrowth and deciduous forest[[1]](https://www.researchgate.net/figure/A-comparison-of-raw-spectral-and-cBGW-classification-of-10-year-old-harvested-stands_fig9_222397391#:~:text=,).  
- **Ancillary data on forest age or structure:** Integrating data like stand age maps or LiDAR-derived structure can help. Young post-disturbance stands might be distinguished by lower height or fractional cover. If available, a **“transitional woodland” class** (as used in CORINE Land Cover) or an age threshold can flag regenerating areas that don’t yet match either mature conifer or mature broadleaf spectral profiles.  
- **Disturbance-informed classification:** Some approaches perform an initial change detection to identify disturbed pixels, then treat those separately (e.g. applying a secondary classification to determine if the regrowth is grass, shrub, or young trees). By acknowledging disturbance first, the classifier can avoid forcing a disturbed pixel into a false mature-type class. In essence, *knowledge of recent disturbance history is used as a prior* to improve current land-cover labeling.

**AVAILABLE DISTURBANCE DATASETS:** (to aid in filtering out such cases)  
- **European Forest Disturbance Atlas (EFDA)** – *Landsat-derived annual disturbance maps for Europe, 1985–2023*. Provides 30 m resolution layers of forest disturbance year and type across 38 European countries. **URL:** [Zenodo 10.5281/zenodo.13333034](https://doi.org/10.5281/zenodo.13333034) (Viana-Soto & Senf 2024).  
- **Global Forest Change (Hansen et al.)** – *Global yearly forest loss dataset at 30 m (2000–present)*. Identifies tree cover loss year for each pixel, useful to mask recent clear-cuts. **URL:** <https://earthenginepartners.appspot.com/science-2013-global-forest> (updated on Global Forest Watch).  
- **MODIS Burned Area Products** – e.g. *MCD64A1 Burned Area* (500 m, monthly) and **VIIRS VBP** (375 m) provide global fire disturbance maps. These can flag areas recently affected by wildfire. **URL:** [MCD64A1 via NASA LP DAAC](https://lpdaac.usgs.gov/products/mcd64a1v061/) (covers 2000–present).  
- **Copernicus** **Land Monitoring** – *High-Resolution Forest Change Layers*. For instance, the Copernicus **Forest Damage** product and national forest inventories offer maps of storm damage or bark-beetle attacks in Europe[[4]](https://essd.copernicus.org/articles/17/2373/2025/#:~:text=for%20the%20disturbed%20class%20of,Soto%20and%20Senf%2C%202024)[[5]](https://essd.copernicus.org/articles/17/2373/2025/#:~:text=disturbance%20occurrence%2C%20severity%2C%20and%20agent%2C,over%20time%2C%20with%20commission%20errors). These datasets, combined with the above, can help pre-identify disturbed areas so that a forest-type classifier can either exclude them or handle them separately, thereby reducing the spectral confusion.

[[1]](https://www.researchgate.net/figure/A-comparison-of-raw-spectral-and-cBGW-classification-of-10-year-old-harvested-stands_fig9_222397391#:~:text=,) A comparison of raw spectral and cBGW classification of < 10-year-old... | Download Scientific Diagram

<https://www.researchgate.net/figure/A-comparison-of-raw-spectral-and-cBGW-classification-of-10-year-old-harvested-stands_fig9_222397391>

[[2]](https://www.fs.usda.gov/rm/pubs_other/rmrs_2011_schroeder_t001.pdf#:~:text=test%20also%20showed%20that%20fire,economic%20policy%20to%20harvesting%20rates) Mapping wildfire and clearcut harvest disturbances in boreal forests with Landsat time series data

<https://www.fs.usda.gov/rm/pubs_other/rmrs_2011_schroeder_t001.pdf>

[[3]](https://www.mdpi.com/2072-4292/14/23/6003#:~:text=Overall%2C%20seven%20sample%20points%20were,and%20urban%20and%20construction%20land) Improved Spatiotemporal Information Fusion Approach Based on Bayesian Decision Theory for Land Cover Classification

<https://www.mdpi.com/2072-4292/14/23/6003>

[[4]](https://essd.copernicus.org/articles/17/2373/2025/#:~:text=for%20the%20disturbed%20class%20of,Soto%20and%20Senf%2C%202024) [[5]](https://essd.copernicus.org/articles/17/2373/2025/#:~:text=disturbance%20occurrence%2C%20severity%2C%20and%20agent%2C,over%20time%2C%20with%20commission%20errors) ESSD - The European Forest Disturbance Atlas: a forest disturbance monitoring system using the Landsat archive

<https://essd.copernicus.org/articles/17/2373/2025/>